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KILBOURNE (H.S.)

alb

THE
PHYSICAL PROPORTIONS
OF THE
AMERICAN SOLDIER

A PAPER PRESENTED TO THE
ASSOCIATION OF MILITARY SURGEONS --
OF THE UNITED STATES,
AND REPRINTED FROM THE
PROCEEDINGS OF THE
SEVENTH ANNUAL
MEETING.

BY MAJOR HENRY S. KILBOURNE,
MADISON BARRACKS, N. Y.
SURGEON IN THE UNITED STATES ARMY.



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THE PHYSICAL PROPORTIONS OF THE AMERICAN SOLDIER.

BY MAJOR HENRY S. KILBOURNE,

MADISON BARRACKS, N. Y.

SURGEON IN THE UNITED STATES ARMY.

THE most capable men¹ of any race or nation, are the typical men; the typical men are those whose physical proportions vary least from all others; whose like in any large group of a people, is found in greater numbers than any other. From this class, all others are deviations, on an ascending or descending scale of dimensions, and a diminishing scale of numbers; hence it follows that the law of deviation having been established from a sufficiently large number of observations, the standard type may be calculated for a still larger number, or for all. Degree of representativeness then becomes the standard of degree of evolution. Three dimensions of the body have hitherto had general acceptance in estimating the physical powers of men; these are stature, chest-girth—including chest-capacity—and body weight, and despite other ~~requirements~~ of modern science, which has attempted to substitute and supplement them, these three within certain limitations, still hold good. It has been ascertained that for every inch of height, between five and six feet, the extreme breathing capacity ("vital capacity") is increased eight cubic inches; the vital capacity is at its maximum at 35 years of age, and there is an annual decrease of 1.21 cubic inches onward to 63 years, backward to 15 years of age.²

The influence of weight on capacity of respiration is less marked than that of height. It is well known to physiologists, that the respiratory processes are intimately connected with the nutrition of the body. These facts support the theory that the physical power of a race, or people, and consequently their capacity for work, is directly as their average stature. The limita-

¹En masse.

²Landois' Physiology.

x *Refinements*

tions of height to physical capacity are important. The law holds good between the extremes of five and six feet, certainly for the white races, and probably for all. Height above six feet, rarely implies a corresponding increase of physical powers; giants are really a feeble folk; and among men of Saxon and Celtic lineage the opposite limit of five feet, is much too low for efficiency. Above the height of six feet, the increase is generally in the lower limbs, without a corresponding development of the trunk and augmentation of strength and endurance. When however the increased dimensions are symmetrically distributed, there is a maximum of power, though not necessarily of endurance. The majority of powerful men are in stature, nearer the average; but blood and fineness of fiber count for work. A man of five feet three inches, may have staying power equal to the best, but as a rule he will not be able to stay long in the company of men of five feet eight inches; but if of the Latin blood, he is not far below the type of his fellows. Stature is largely a matter of race, yet within racial lines it is also a matter of class, and among classes, it is affected by age and occupation, but most of all by the standard of living. A well-fed people will, other things being equal, surpass in stature those habitually under-fed; scantiness of food arrests growth. The health and strength of all peoples are intimately dependant on their diet.¹ Among civilized people, the professional classes are everywhere superior in height to the laboring classes; the white races are generally taller than the dark races. The Anglo-Saxons, Celts and Scandinavians are of greater stature than the peoples of Southern and Eastern Europe. Americans, a composite people, in whom the blood of Northern Europe predominates, are taller than their German and English ancestors; and of Americans, the men of the West and South are of greater height than those of the North and East. Among the American aborigines, the dominant tribes of the North, the Iroquois, Sioux, and Nez Percés, were of greater stature than the Comanches and Cherokees of the South.

The following table exhibits at a glance the average stature of peoples of various races and nationalities and especially the

¹Atwater—Chemistry and Economy of Food, Bull. 21, U. S. Dept. of Agriculture, 1895.

height of the immigration classes of the United States, according to the latest available authorities:

RACE OR NATIONALITY.	AUTHORITY. 1	REMARKS.	METERS	FEET.	INCHES.
Polynesians	Various .....	.....	1.762	5	9.33
Patagonians	D'Orbigny .....	.....	1.754	5	9.00
Angamis	Woodthorp	Naga Hills	1.754	5	9.00
Negroes	Topinard	Congo	1.752	5	8.95
Scotch	Brit. Anth. Com. ....	.....	1.746	5	8.71
N. A. Indians	Baxter .....	.....	1.728	5	7.93
Irish	Brit. Anth. Com. ....	.....	1.725	5	7.90
U. S. White	Baxter	Northern U. S. ...	1.719	5	7.67
English	Baxter .....	.....	1.719	5	7.66
Norwegians	Baxter & Beddoe .....	.....	1.719	5	7.66
Zulus	Roberts .....	.....	1.707	5	7.19
Scotch	Baxter	U. S. Immigrants ..	1.705	5	7.06
Canadians	Baxter	U. S. Fr. Immig. ..	1.703	5	7.01
Swedes	Baxter & Beddoe	U. S. Immig	1.700	5	6.90
Irish	Baxter	U. S. Immig	1.698	5	6.74
Welsh	Brit. Anth. Com. ....	.....	1.695	5	6.66
Danes	Baxter	U. S. Immig	1.694	5	6.65
Dutch	Baxter	U. S. Immig	1.693	5	6.62
Ameri'n Negroes	Baxter .....	.....	1.693	5	6.62
English	Baxter	U. S. Immig	1.692	5	6.58
Hungarians	Baxter	U. S. Immig	1.692	5	6.58
Germans	Baxter	U. S. Immig	1.691	5	6.54
Swiss	Baxter	U. S. Immig	1.687	5	6.38
Russian	Baxter	U. S. Immig	1.687	5	6.38
Belgians .....	.....	.....	1.687	5	6.38
French	Baxter	U. S. Immig	1.683	5	6.27
Poles	Baxter	U. S. Immig	1.682	5	6.20
French	De Quatre fages	Upper Class	1.681	5	6.14
Germans	Novara .....	.....	1.680	5	6.10
Mexicans	Baxter .....	.....	1.680	5	6.10
Italians	Baxter	U. S. Immig	1.677	5	6.00
Austrians	Novara	Slavs	1.669	5	5.68
Spaniards	Baxter	U. S. Immig	1.668	5	5.66
Portuguese	Baxter	U. S. Immig	1.663	5	5.43
French	De Quatrefages	Working Class	1.657	5	5.24
Bavarian	Novara .....	.....	1.643	5	4.68
Chinese	Novara .....	.....	1.630	5	4.17
Poles	Mayer .....	.....	1.622	5	3.87
Japanese	Ayrtaun .....	.....	1.604	5	3.11
Malays	Various .....	.....	1.583	5	2.34
African Pigmies	Stuhlman .....	.....	1.250	4	1.21

We note in the foregoing list, the obvious superiority of the Celts among northern Europeans; the Scotch overtop all the whites and are closely followed by the American Indians. The most notable feature for our attention, is the variation from the

¹Smithsonian Reports, 1884, mainly.

averages given by other authorities, of the foreign population of the United States as computed by Baxter from the measurements of more than half a million of enrolled men, from which the Federal Armies were drawn during the American Civil War. In some instances there is shown a gain and in others a falling off in height; the latter is marked in British immigrants, while in the French there is a gain over the higher class of their nationality. Among the United States'whites, of Baxter, the Southern States which had formerly furnished the tallest men for the army, are not proportionately represented. The true standard for the native Americans of that period is probably nearer sixty-eight inches. Taking the largest statistical group of native white Americans, now available for study, we have the following exhibit for the determination of the height and chest girth of the men of the North and West, of the last generation.

TABLE SHOWING THE HEIGHT, CHEST-GIRTH AND AGE OF 190,621 NATIVE WHITE AMERICANS, EXAMINED AND ACCEPTED FOR THE MILITARY SERVICE OF THE U. S. 1863-5 (BAXTER):

HEIGHT.	NUMBER	AGE 18 TO 45.	CHEST GIRTH.	REMARKS.
Under 61 inches..	609			
61 to 63 " ..	4929			
63 " 65 " ..	21712	Mean Age	Mean Chest Girth,	
65 " 67 " ..	47731	26 96 Years.	35.25 inch.	
67 " 69 " ..	58348	.....	.....	Type.
69 " 71 " ..	38935			
71 " 73 " ..	14858			
73 inches and over	3499			
Total 190621		Mean Height 67.35.		

In this group the number of men below 63 inches in height is seen to be but little greater than that of the class above 73 inches. The most numerous and therefore the typical class, is included between 67 and 69 inches. This standard class having a greater number of other classes below, than above, it would accordingly have a greater chest girth than the average for the whole group. For the sub-groups, the data are incomplete.

The following tables afford figures of a later date, but of numbers not sufficiently large for a safe generalization:

TABLE OF PHYSICAL PROPORTIONS OF NATIVE WHITE AMERICANS OF DIFFERENT CLASSES.

CLASS.	NUMBER.	YEARS MEAN AGE.	INCHES MEAN HEIGHT.	POUNDS MEAN WEIGHT.	CHEST MEASUREMENTS.			RATIO OF WEIGHT TO HEIGHT.
					INCHES MEAN CHEST GIRTH.	INCHES MEAN CHEST MOBIL.	CU. INCHES MEAN CHEST CAPACITY.	
U. S. Naval Cadets. ¹	272	24.01	67.69	137.86	34.14	3.33	2.42	2.036
Amherst College Students. ²	1416	24.18	68.31	138.90	36.74		2.61	2.033
U. S. Army Rec'ts Native White.	4547	26.80	67.50	145.06	35.58	2.91		2.134
U. S. Naval Cadets. ³	125	23 to 27	67.80	139.00	34.30	3.50	2.44	2.050

The mean height of 125 U. S. Naval Cadets above the age of 23 years, was 67.80 inches.³ As these men are drawn from all parts and classes of the United States, they represent very nearly the typical physical development of the American people of 25 years of age. From what source has the superior stature of the Americans been derived? Assuming that the relative height of the ancestors of the Colonists was as their national types remain to-day, we find the racial type of stature in the large limbed Celt, whose physical proportions are still the first in Europe. Next in order is the English blood, a composite strain bred on the Anglo-Saxon stock. The Northmen are third, led by the Norwegians and Swedes, the Danes ranging below the latter, but above the Germans. All these are well above the average height of man.⁴

¹Gihon—Reference Hand Book of the Medical Sciences.

²Annual Report of the Surgeon General U. S. Army, 1895.

³Gihon—Ibid.

⁴5' 5.25''.

The relation of body weight to vital capacity, appears in the physiological law, that when the body weight exceeds the normal by seven per cent., there is a diminution of 37 c.c. (2.2 cu. in.) of vital capacity for every kilo (2.2 lbs.) of increase of weight.¹ This again confirms the view that respiratory capacity, rather than body weight, is the better indicator of the physical *stamina* of a people.

Assuming the normal weight to vary with race and climate, which is probable, the average American of 145 lbs. would begin to be overweight at 155.16 lbs., and beyond that weight would lose in vital capacity. Considering these figures, we are inclined to believe that too much importance has hitherto been attached to the value of the ratio of weight to height. Effective weight should be chiefly in bone and muscle, for fat more than is necessary for filling in and rounding the figure, is dead weight, and diminishes, rather than augments capacity for work.

The *maximum* American Army service weight of 190 lbs. is well placed; an overweight man is handicapped by his surplus flesh and expends his energies in carrying it about. But the underweight man lacks quantity of bone and muscle for effective work. Muscle may be built up on a sound frame, as a builder fills in the material of a house, but the trainer cannot, like the builder, supply certain essential materials, where nature has failed to provide them; he can only enlarge and develop what is already in place. The elemental muscular fibers must not be wanting in the human structure. According to Gihon, increase of height practically ceases with the twenty-third year, which he considers the period of completion of adolescent growth,² but his record of measurements of cadets shows an increase beyond that limit, and the record of Amherst students exhibits a gradual increase of stature up to the twenty-sixth year, with a corresponding increase of chest girth and weight. Military statistics confirm the view that development continues into the sixth quinquennium, and that the *maximum* development of Americans is found between the ages of 25 and 30 years. After the period of full development is reached, the excess of nutritive material, over and above that required to maintain the

¹ Landois' Physiology.

² Surgeon Beyer, U. S. Navy, from observations on Naval Cadets fixes this period two years earlier.

body in health, is deposited in fat; and it will be found that a disproportion of weight over height occurs usually in adults or men of middle life.¹

The effects of systematic physical training on the development of the body are too well known to require more than an allusion here; it is not perhaps so well known that such training is capable of increasing the stature on an average of one and three-fourths inches above the limit obtained without training; and what is of more importance, it has been shown, that the taller the individual at the beginning of the training, the greater also was the amount of weight and strength gained by the exercise he was made to perform; an increase in height, therefore, means a corresponding increase in strength as well. "The agent, whatever it may be," says Surgeon Beyer, "which influences height, must be profound as well as far-reaching, for growth in height means growth in bone."²

Most important of the three body dimensions are those of the chest; three kinds of chest measurements are employed. These are the chest girth, chest mobility,—or expansion in respiration—and chest capacity ("vital capacity"). These, although closely related, are not convertible terms. A man may have a large chest, without amplitude of expansion or mobility; the chest in well developed men is ample, it contains the vital machinery and represents the staying powers of the man.

The average vital capacity (volume of air expired in forced respiration) in well developed Americans is rather more than a gallon (U. S. standard 231 cu. in.). The tidal air of ordinary quiet breathing is about a pint. The chest expansion, in mature, well-formed Americans is about three inches, which is the difference in chest girth in full expiration and inspiration. The later reports of the Surgeon General of the U. S. Army furnish data for comparison of the physical proportions of the native white, colored and foreign population, from which recruits are drawn. The ratio of foreign-born to natives, in the following table, is much larger than in the aggregate population, and, as during the present year, enlistments have been restricted by citizenship, the military ser-

¹Greenleaf's *Epitome of Tripler's Manual*.

²On Normal Growth under the Influence of Gymnastic Exercise—Report of the Surgeon General, U. S. Navy, 1896.

vice has already become more representative in character. The tale of foreign immigration, which has been large and continuous for more than half a century, probably touched high water in the census of 1890; at that period, in a total population of sixty-two and one-half millions, nine and one-fourth millions were of foreign birth; a ratio of 1 to 6.77. Of 7,434 recruits accepted during the year 1894, there were native whites, 4,547; foreign whites, 2,388; negroes, 499, with a ratio of foreign to native white of 1 to 2. A large majority of the foreign recruits were British and Germans.

AVERAGE HEIGHT, WEIGHT, CHEST MEASUREMENTS, RATIOS OF WEIGHT TO HEIGHT AND RELATIVE ORDER OF PHYSICAL PROPORTIONS OF 16,077 RECRUITS ACCEPTED FOR THE U. S. ARMY, DURING THE YEARS 1894-95, ALSO OF 197 INDIANS ACCEPTED IN THE YEAR 1892.*

RACE OR NATIVITY.	NUMBER EXAMINED AND ACCEPTED.	AVERAGE HEIGHT, INCHES.	AVERAGE WEIGHT, POUNDS.	CHEST MEASUREMENTS.			RATIO WEIGHTS TO HEIGHTS IN SQUARES.	CUBIC RATIO.	RELATIVE ORDER OF PHYSICAL PROPORTIONS.	RELATIVE ORDER OF PHYSICAL PROPORTIONS.	RELATIVE ORDER OF PHYSICAL PROPORTIONS.	RELATIVE ORDER OF PHYSICAL PROPORTIONS.
				AVERAGE INSPIRATION, INCHES.	AVERAGE EXPIRATION, INCHES.	AVERAGE DEPTH, INCHES.						
1894 Aver. Age 26.8, U. S. Native, White.	4547	67.50	145.06	34.08	36.99	2.91	2.14	II	IV	III	III	III
Foreign Born, Wht.	2388	67.18	146.77	34.63	37.57	2.94	2.18	IV	II	II	II	II
American Negro ..	499	67.21	149.19	34.25	36.83	2.58	2.21	III	I	IV	I	I
American Indian ...	197	68.30	146.04	33.64	36.80	3.16	2.13	I	III	I	IV	IV
1895, Aver. Age 27.2, U. S. Native, White.	5699	67.68	145.68	34.26	37.17	2.91	2.15	II	IV	III	III	III
Foreign Born, Wht.	2351	67.14	147.18	34.80	37.73	2.93	2.19	IV	II	II	II	II
American Negro ...	593	67.37	149.85	34.27	36.89	2.62	2.22	III	I	IV	I	I
American Indian ...	197	68.30	146.04	33.64	36.80	3.16	2.13	I	III	I	IV	IV

The salient features shown in the detailed tabulation are, first, a regular increase in all the dimensions up to, and including the

* Reports of the Surgeon General of the Army, 1893-5-6.

group of the mean age. Second, an increase of weight with age beyond maturity. Third, a loss of height and chest expansion with advancing age beyond the fortieth year. These features appear constant in all classes of the recruits of the three years, excepting that the maximum height of the Indians and of the recruits of 1895, was attained before the twenty-fifth year. Comparing the averages of the foregoing table, we find that of the four race classes the negro has the greater weight, and the native white the least; the greater chest girth is shown by the foreign white and the least by the Indians; the native white is superior in stature to all but the Indians. The relation of stature to vital capacity is marked in the savage; his additional inch of height taking him to the head of the list in respiratory power, notwithstanding his lesser chest girth, both before and after the period of maturity. On the other hand, the surplus weight of the negro goes along with the diminished lung power. The slight superiority of stature of native whites is not accompanied by a corresponding increase in respiratory power. The larger ratio of height to weight does not take with it an increase in chest capacity in the negro. A comparison of the totals of all ages is vitiated by the greater youth of the native whites. But it appears that notwithstanding a greater proportion of their number below the age of 25 years, their mean average chest expansion was but .03 inch less than that of the older foreign whites. While in the immature class, the native white, with the least weight and one-half inch less chest girth, has a chest expansion which is practically the same as his foreign comrade. Selecting the two groups, between 20 and 30 years, the results differ somewhat.

In the following table, the all-round superiority of the savage at the period of maturity is strikingly obvious. The comparison is valuable, however, only as showing the physical proportions of the highest class of the aborigines, the principle of selection in their case having been carried further than has been done in other selections of the majority of soldiers. The actual gain in weight here shown in the native whites, on reaching maturity, does not appear to be accompanied by a corresponding gain in the relative order of the respiratory power. On the whole then, the native white soldier appears to be taller and slighter in mould than his foreign comrade; he has accordingly less juice and more bone. These

AVERAGE HEIGHT, WEIGHT, CHEST MEASUREMENTS, RATIO OF WEIGHT TO HEIGHT AND RELATIVE ORDER OF THESE PHYSICAL PROPORTIONS OF 5,237 RECRUITS FROM 20 TO 30 YEARS OF AGE, ACCEPTED DURING THE YEAR 1894, AND OF 139 INDIANS ACCEPTED DURING 1892:¹

RACE OR NATIVITY.	NUMBER EXAMINED AND ACCEPTED.	AVERAGE HEIGHT, INCHES.	AVERAGE WEIGHT, POUNDS.	CHEST MEASUREMENTS.			RATIO OF WEIGHT IN POUNDS TO HEIGHT IN INCHES.	ORDER OF HEIGHT.	ORDER OF WEIGHT.	ORDER OF CHEST MEASUREMENTS.	ORDER OF RATIO OF WEIGHT TO HEIGHT.
				EXPIRATION, INCHES.	INSPIRATION, INCHES.	STABILITY, INCHES.					
Age 20 to 24 Years, Average 22 Years.											
U. S. Native, White	2432	67.49	123.6	33.88	36.78	2.90	2.127	II	IV	III	III
Foreign Born, Wht.	828	67.21	144.5	34.36	37.28	2.92	2.147	IV	III	II	II
American Negro...	188	67.24	145.8	34.22	36.70	2.48	2.168	III	I	IV	I
American Indian ..	90	68.55	145.2	33.67	36.93	3.26	2.116	I	II	I	IV
Age 25 to 29 Years, Average 26.8 Years.											
U. S. Native, White	1103	67.58	146.5	34.33	37.27	2.94	2.167	II	III	III	IV
Foreign Born, Wht.	657	67.22	145.9	34.48	37.50	3.02	2.170	IV	IV	II	III
American Negro...	119	67.40	149.7	34.08	36.74	2.66	2.221	III	II	IV	II
American Indian ..	46	68.45	152.2	34.40	37.72	3.32	2.223	I	I	I	I

NOTE.—Standard minimum height 64 inches. Minimum weight 125 lbs. Minimum chest-girth 22½ inches. Minimum chest mobility 1 inch. Minimum age 21 years, except by consent. Maximum height governed by maximum weight. Maximum age 30 years, excepting enlistments.

features he has acquired in part from his native soil, over whose dryer continental areas lately reigned a tall and sinewy aboriginal race. Considering the body as a machine, the American workman has as strongly built a machine as any other and more fuel to run it with than his European brother. While it is not absolutely proven, it seems in the highest degree probable that the higher

¹ Reports of the Surgeon General, U. S. Army.

standard of living, the better nutrition of the body, the larger product of labor and the higher wages go together.¹ In estimating the physical capacity of a people, the question of quality cannot be excluded. Apart from stature and muscular development, the uncivilized man is less powerful than the civilized man; he is unable to expend suddenly as great an amount of force, and he is unable to continue the expenditure for so long a time. An irregular food supply, mostly inferior in quality, dirty and uncooked, besides entailing mechanical loss, gives to the primitive man only an irregular supply of nervous power, smaller in average amount than that which follows good feeding.²

Another question remains to be considered, What is the proportion of these able-bodied men to the entire population? The number of recruits rejected on primary examination, as shown by the reports quoted above, equals the number accepted. The causes of rejection, though mainly diseases and deformities constituting imperfect physique, also include mental and moral infirmities, as well as some disqualifications referable to social and political status. The census of 1900 will show of men of all classes, from 20 to 29 years of age,—the flower of the nation—a number exceeding six millions; dividing this number by two, there will remain a possible military potential of three millions of this class alone; not of soldiers, but of the raw material of which soldiers are made. If but one in five should be called into service, they might compose an army larger than any now organized. General anthropometric statistics of the American people are yet wanting; those collected during the Civil War pertained chiefly to the Northern States, already depleted of the flower of their youth: No similar records of the Confederate armies are available, and the Southern States, prior to the war, furnished the larger men of the army. Since the war, the South has, excepting colored men, furnished comparatively few soldiers. While military statistics cannot be accepted as conclusive in estimating the physical character of a nation, unless the army be the nation in arms and the quiescent army the people, all available statistics tend to prove that an enrollment of the American people, which would separate all those incapacitated by disease and infirmity, would show a physical de-

¹Atwater—Bull. 21, U. S. Dept. of Agriculture.

²H. Spencer, *Sociology*.

velopment not below any standard, and second in quality of form and condition to no other in the world. Our figures thus far have enabled us to arrive with tolerable precision at the physical proportions of the average American. But such a method produces an arithmetical phantom—not a veritable man—for by actual enumeration few will be found to conform exactly to a standard so obtained. By the method of counting the most numerous class between fixed limits of height, a standard type of stature is obtained. From this basis by a continuation of the method, the other physical proportions are deduced, and a rational and practical standard secured. We turn in vain to the enormous assemblage of figures in the census for such data. Buried in this huge statistical shell heap, lie many things of value to the statesman, the economist and the politician, but the physical proportions of the American people are not yet to be found among them.

And here finally comes into view a significant question: The Americans are a composite people resulting from the blending of various nationalities; the type now is, and for some indefinite time will continue to be a variable. The commingling strains of alien blood have thus far apparently worked no deterioration of quality; they are remotely of the same stirp as our own, homogeneous and compatible. Not so the swarthy, low-browed and stunted peoples now swarming to our shores. Absorbed into the body of the people, these multitudes must inevitably evolve an inferiority of type. To realize the result of such a contingency, let it be considered that the loss of an inch in stature might bring in its train the loss of national ascendancy. Let us take care then that the State shall suffer no injury.

